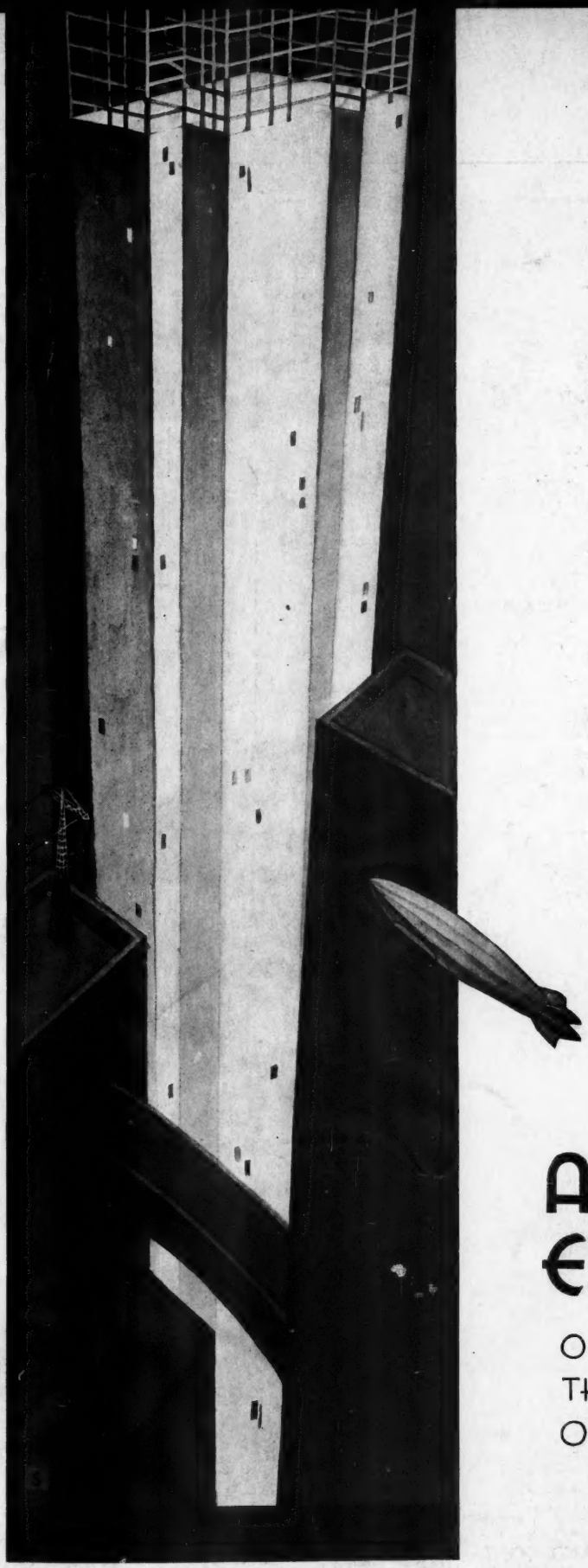

The AMERICAN ENGINEER

OFFICIAL PUBLICATION
THE NEW YORK STATE SOCIETY
OF PROFESSIONAL ENGINEERS

JULY • 1931

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OFFICIAL PUBLICATION
OF
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SAUGERTIES, N. Y.
and
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Arthur V. Sheridan, Editor

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THE NATION'S DILEMMA

And The Engineer's Opportunity

In these days of congresses, conclaves, loans, doles, moratoriums and other proposals held forth as panaceas for the financial stress which today strains the entire world, one more suggestion can scarcely be considered a chimerical idea. What is here set forth pertains particularly to the United States, but the principle appears to the writer to be equally applicable to all nations.

The great war demonstrated the feasibility and desirability of drafting the man power of a nation in an hour of need. For the first time these United States called upon every available man, between certain ages, to offer himself as a sacrifice to the common good. That a universal draft of man power is fair, practicable and effective was proven beyond all question of doubt. Even the question of personal rights and of constitutionality has been decided. There is every reason to believe that, if a similar emergency again arises, not only the man power but the wealth and resources of the nation will be drafted, and every man, woman and capable child will be called upon to serve the country at the same rate of compensation as does the soldier. The American Legion, which is most qualified to pass judgment or opinion has made of this policy a cardinal principle.

Times of stress are not necessarily restricted to those of war. Again stress, and particularly financial distress, may cause war within a nation. It is not impossible for anarchism to become rebellion and, if successful, revolution. Logic will not feed and clothe human beings and once the flood gates of emotion give way anarchy takes the place of law. History has proven too often that human beings are not inanimate matter always obedient to physical laws. Failure to appreciate the intensity of human emotion has caused many political upheavals, some of which have shocked the entire world and left in their wake desolation and death before order emerged from the chaos of rebellion and revolution.

The approach of another winter is sufficient to cause concern to the people of the United States. Unemployment shows no signs of decreasing and the tendency to flock to the cities is not an omen of patient endurance.

Several proposals, such as those of Senator Wagner, Senator Copeland, Wm. R. Hearst and various others have been discussed and considered. In almost every instance wherein a program of public works, giving employment has been proposed, it has received the unqualified approval of officials, legislators, press and public. The question has been to finance a program sufficiently large to give employment to all who need work.

Figures quoted in the public press indicate that there are some forty-three million workers in this country. It is difficult to estimate the average income of these people but when the earnings of the multi-millionaire are combined with those of the laborer it is probably somewhere between one and two thousand dollars per annum. One percent of the average yearly income would yield from ten to twenty dollars per person. On a basis of the smaller average income, forty million times this amount would be $400,000,000. Two percent would mean $800,000,000, three percent would amount to $1,200,000,000 and four percent would total $1,600,000,000.

It has been estimated that the expenditure of $400,000,000 annually on public works would provide employment for approximately 250,000 persons at an average of $25.00 a week. For each $400,000,000 expended an additional 250,000 could be employed.

This seems a staggering amount and one is well aware of the numerous practical difficulties and even objections, but it is not impossible if the proper agencies are created. The amount involved is small compared to the annual expenditure during the World War.

As a concrete recommendation the writer suggests that the required money be raised in the following manner:

Enroll every wage earner in the United States in the same manner as was done in the case of

A COURAGE BORNE OF IDEALISM

Fifty Years of Unavailing Effort

If there is any occasion to refute the contention that engineers lack imagination one need but turn to the person of Gustav Lindenthal.

For a half century he has sought to make his dream to span the Hudson a reality. It is now almost an accomplished fact, but the dream has been materialized by some one other than the dreamer of so many years.

Despite obstacles, other than those of engineering, that have increased with time he continues to strive heroically to overcome them.

The feasibility of spanning the great river has been demonstrated and, to that extent at least, Gustav Lindenthal, the dreamer, has been vindicated. Despite his more than four score years he may yet demonstrate the practicability as well as the possibility of connecting the heart of Manhattan with New Jersey.

The following editorial from the New York-World-Telegram of June 12th is a splendid tribute to a master creator as well as a dreamer:

A GRAND OLD MAN

Hats off to 81-year-young Gustav Lindenthal, famous engineer and bridge builder, who, despite three War Department rejections of his plans for a gigantic 57th St. bridge across the Hudson, nevertheless refuses to give up.

"On the contrary," he declares, "I am more hopeful than ever. It is an absolutely necessary improvement. It must be accomplished."

That is fine spirit in a man of four-score who is not satisfied with Manhattan, Queensboro and Hell Gate bridges, to say nothing of the remodelled Brooklyn Bridge, to his credit, but pushes on with the biggest suspension project of all on which he has worked for forty-two years.

There are graver objections than the Army objections to the 57th St. bridge plan. But if anything could make us forget them it would be the indomitable courage, conviction and enthusiasm of Gustav Lindenthal.

THE NATION'S DILEMMA

(Continued from Page 3)

drafting man power during the war. Determine the income of every person. Tax every income a specified percentage. The money so received could be used to carry on public works throughout the length and breadth of the United States. Every person should be compelled to appear at stated intervals before a board and any change in his financial status noted. There should be no exemptions, and the rates should be based upon the needs and the practicability of inaugurating work. Such policy could be continued as long as the emergency exists and could be modified to meet changing conditions.

This may appear to some to be a very radical proposal but after all is it? Is it not preferable to internal strife that would undoubtedly result in destruction, death and confiscation of property? And would it not create a nation of beauty, civilization and, at least material, accomplishment beyond the dreams of idealists?

One of the growing abuses in the nation is the organization of private charities. What any civilized nation requires is not charity for indigents and impoverished but the provision of labor for such persons. Regardless of how altruistic, laudable and seemingly warranted it may appear, funds collected and distributed through private agencies do not and cannot serve the needs of a great nation. The average person probably contributes more in a year to so-called charity than he would be called upon to pay as a percentage of his income to the government. Were these charities combined under one governmental agency all the poverty and distress resulting therefrom could be eliminated at less cost to the individual citizen.

To the writer the creation of the proper governmental machinery and the selection of a man of the calibre of a Pershing to direct such machinery would result in a new era of prosperity. Such a program as is suggested is not nearly so difficult of accomplishment as is the conduct of a great war.

As in the case of war, the engineer would be called upon to play a most important role. The result would be the development of the entire nation. Roads, harbors, transportation, sanitation, water supply, power and light, public edifices and countless other projects which are actual needs would not only provide employment for all but would make of America the wonder nation of all time.

This proposal is not a panacea or a permanent insurance against economic depression but it offers at least relief and would prevent sacrifices far greater than merely a percentage of every one's income. It is offered solely as a suggestion with a view to developing and keeping in circulation the wealth of a nation which has resources far beyond its needs. To the engineer is afforded the opportunity of accepting a role he must assume ere another generation shall have passed.

EDITOR.

ENGINEERING—A CULTURAL INFLUENCE

The Engineer Must Lead Not Follow

The writer wishes to preface the following remarks with the statement that the same express a purely personal viewpoint and are offered with the hope of stimulating interest and reflection upon the part of the members of a profession which has contributed much to civilization, but which has largely alienated itself from the humanities of life in the doing thereof.

The engineer, like all other human beings, is a member of society, and as such has his obligations thereto. The advancement of science and the creation of material comforts are not the measure of fulfillment of the engineer's function or place in that society. He must play a role in directing mankind toward its ultimate destiny.

Though nature be the field of the engineer's endeavors, mankind is the object of his efforts, and to go too far afield is dangerous, for man grows presumptuous and feels himself self-sufficient. That which he cannot understand or explain he is oft times inclined to discard.

The humanities of life touch every member of society, and the knowledge obtained from contact with the rest of mankind clearly indicates, as does the absolute logic of reason, that concern must be given the affairs of everyday existence if civilization is to survive and develop.

In order that the efforts of engineers may be regulated and led into proper channels, and that the preservation and development of society, and not its destruction, shall be the ultimate end of these efforts, the engineer must identify himself with, and ascertain the needs of, that humanity of which he is a part. Safeguards must be thrown around the practice of engineering and precautions taken to keep the calling which has done so much for humanity, and which the future of society seems predicated upon, from sinking to the level of a skilled craftsmanship. Such a development would compel engineering to reject the high destiny which all nature points to as the natural function of the profession which applies the great universal and immutable laws of nature for the convenience and welfare of mankind.

The transition from primitive existence to urban life is the story of engineering. With this change has come the accompanying responsibilities of communal existence. No longer is man dependent only upon nature and its elements. No longer does responsibility confine itself to the individual.

No profession or calling has a right to arrogate to itself a place of isolation or a plane of complacent satisfaction or superiority. All callings deal either directly or indirectly with human beings, and the accomplishments of a profession are merely one of the Divinity's ways for shaping humanity's course through this sea of universal destiny.

It is difficult to understand how a profession which has contributed generously to the welfare of mankind has so alienated itself from the influences of humanity as has engineering. To give its scientific accomplishments to the world is not the Alpha and Omega of a profession's purpose or scope. It is only through the reaction of humanity that a profession can function in that ennobling direction of exerting a refining, cultural influence upon mankind and, herein, the engineer has failed to develop the full potentialities of his calling.

Engineers have been inclined, as a whole, to separate themselves from the cultural world and to apply their thoughts intensely, and rather exclusively, to an application of the sciences and their laws to matter. This is unwise because the world needs the cultural influence that a profession can and should exert in order that it may appreciate the contributions of that profession to the welfare of mankind.

Reflection upon immaterial things that affect the progress of humanity should be the concern of everybody, and merits especially the attention of a professional man. As one schooled in a knowledge, small though it be, of the great immutable laws of the physical universe, the engineer should, for example, take a leading part in defining and limiting the terms and usages of expression pertaining to science and its applications.

One of the unfortunate conditions prevailing today is the indiscriminate use of terms intended to represent specific phases of human knowledge and human endeavor.

Perhaps no word has been so much abused and misused as the term "science." So far as the human understanding goes, most of the studies termed science are misnamed. From the derivation of the word a subject is definitely a science or it is not. There is a distinction between knowing and believing; between knowledge commonly accepted by all mankind and ideas or opinions held by individuals. If we can codify the laws, rules and limitations of a subject in such a manner that any person by a proper affirmative application of the same will invariably produce the same result, or that no person can by negative application prove the contrary, then that subject is truly a science. Physics, mathematics, chemistry and

pure logic will, for example, in general survive these tests. They are sometimes termed exact sciences, but science should be exact or it has no claim to the term, and practically all the ologies and isms that are classified as science belong purely and simply to the field of speculative philosophy or thought, so far as man is concerned, and should be so catalogued. There surely should be some distinction between subjects based upon the immutable laws of nature and those born of the imperfect imaginations of men, and which are not capable of reasonable demonstration or even similar results when applied under identical conditions by different people.

The term "science" as at present used has no clearly defined meaning. Everything today is scientific, and subjects that men cannot understand or agree upon are termed science, and people are led to wrong conclusions and oft times to mental disorders because they believe they are dealing with a science whereas the very premise of the subject precludes scientific results.

You may ask what concern have engineers with such matters. Simply this: the present tendency toward specialization causes us to accept without investigation, teachings and doctrines which are purely opinions, simply because they are called sciences, and relegates to the background two very vital factors in the well-being of humanity, viz: tolerance and true wisdom. This may appear far-fetched, but all intolerance is born of ignorance, and ignorance of the generalities and humanities of life, and of the premises upon which theories are founded, can and will breed intolerance amongst so-called scientific men, just as surely as it has amongst people who are intolerant of their neighbors because they do not know or understand them. Intolerance precludes wisdom and a world devoid of wisdom hovers on the edge of an abyssmal darkness or chasm.

A true understanding of a real science is the greatest step toward ennobling a human being, but the mechanical application of scientific principles has a tendency to fill men with a dangerous ego, and, unless the applications be limited to real scientists or tempered by reflection upon the part of the great majority of those who apply science, such as doctors, engineers, chemists, etc., the unbridled use of scientific principles may destroy rather than preserve and uplift mankind.

The average person must possess something more than the knowledge necessary to practice his own calling, in order to preserve culture and civilization amongst mankind, and it is only by contributing constantly to society that human beings can be kept above the plane of the primitive animal.

Engineers are responsible for cities, and cities are largely responsible for culture, so that it follows most rationally that the engineer is a forerunner of civilization and culture. But he must not alienate himself from the things he has brought into being, lest he be neglected and overwhelmed by the very children of his own creation. The engineer has developed civilization; let him preserve it.

Never was a profession more in need of guidance than is engineering today. The investigations and discoveries of the last century disclose how limited is the extent of our knowledge and the dangers of positivism. From the heyday of Grecian natural philosophy to a generation ago, or in about 2300 years, chemistry advanced from four to about seventy elements in subdividing matter. In the last thirty or forty years alone, the number has risen from seventy to a possible ninety-two.

Physics has expanded, to the extent that its ramifications in electricity alone, from Franklin and Faraday to Steinmetz, Marconi and others of our time, are so enormous as to confound humanity.

The evolution of bridge building from the wood, cast and wrought iron frames of seventy-five years ago to the steel suspension span across the Hudson is a tremendous step. The development of the theories of rigd frames, skew arches and multiple arch dams, indicate a rapid march into the field of a hitherto no-man's land. The applications of reinforced concrete presage the removal of many of the limitations of materials possessing low moduli of elasticity.

All these things depict the constant change that is taking place about us, and as the fastest thoroughbred requires control, so, too, do engineering and applied science, in the speaker's judgment, need guidance.

Engineering is a calling with a history and accomplishment that should justify a pardonable human pride in its contributions to mankind, and the very nature of its premises draws mortals closer to the divinely ordained purposes of the Great Engineer of the Universe than any other profession. It should inspire in its practitioners that love of the aesthetic, cultural and harmonious that descends directly from the superior intelligence of a creator to the more limited intellect of the creature.

Let, then, the engineer take his place amongst the leaders of thought and lend himself to a consideration of the humanities of life.

Let him vie with the Athenians of old who surpassed in Architecture and in Sculpture, but whose fame rests as firmly upon the culture of Plato, Aristotle and Aristophines, as it does upon the Pantheon, the Atheneum or the Acropolis.

Above all let him be tolerant of the opinions of his fellowmen, for none of us can afford to forget the words of immortal Hamlet:—

"There are more things in Heaven and Earth, Horatio, than are dreamt of in your Philosophy."

THE CHEMICAL ENGINEER IN BUSINESS

Pride of Authorship

or

Seeing the World as Others See it

By JOHN MORRIS WEISS
Director New York State Society

The following somewhat unusual expression from an engineer appeared in Chemical and Metallurgical Engineering of May, 1931. Its author is a director in the New York State Society and a recognized expert in the field covered by the article:

The success of Briggs as a cartoonist was certainly to a large extent due to his keen insight into human nature. One series of his, entitled "Me and Mine," which you have probably seen, is based on the tendency of the average man to magnify mentally that which is his and depreciate the same thing if possessed by the other fellow. The proud parent is a typical example of this tendency, which may be called "Pride of Authorship."

Pride of Authorship enters the business world as well as the more personal relationships of mankind and crops up in many unexpected places. It is responsible for many real successes and likewise for many avoidable failures. None of us is free from it; we would be superhuman if we were. It is a powerful driving force like a mighty river and it seems wise to consider how to safeguard it, as the river is restrained by levees, so that at the proper time its force may be kept within its proper channels and diverted from destruction.

Throughout the entire course of technical development, we have to reckon with the pride of authorship, not only in individuals but in entire organizations. We must not repress it too far, for it is the material of which the much desired "esprit de corps" is made. It must be recognized, encouraged, but likewise restrained to an extent sufficient to allow its major conclusions to be submitted to adequate analysis.

Processes usually start with a technical or scientific idea. No parent can be as jealous or enthusiastic as the more creative type of scientist with a new-born idea. If the first hasty experiments have even a modicum of promise, he is already visualizing the completed successful industry, inclined to brush away all suggested difficulties or obstacles with a wave of the hand, and forget that the dividend is still in the distance. Such enthusiasm is a valuable asset, but if allowed to run without intelligent check-up, may prove disastrous. Such a check is the function of modern chemical engineering.

With any new proposition or idea, there is the necessity for a careful, impartial appraisal of the real commercial possibilities coupled with sufficient imagination to visualize these possibilities. This appraisal or review should precede any considerable expenditures of capital so as to determine whether the gamble—for all initial development work is a gamble—is a reasonable one. From the angle of the chemical engineer, the proper course is to take such information as is available, assume the process or idea will work as the originator desires, and set up a dollars and cents balance sheet of expected costs and returns. Of course, such a study will be very rough and many assumptions will have to be made, but these assumptions can be made on a maximum and minimum basis in most cases. Now, if all factors are chosen on the basis most favorable to the new development, and it still cannot be presented so as to show prospective profits, it is obvious that it should be abandoned. Sometimes, of course, the data available are insufficient to form a positive opinion, but in this case the review performs the very useful function of showing what information is essential. In this way the initial effort can be directed to the determination of these missing factors, and expenditure concentrated where it enables an intelligent decision to be made within the least space of time and at the least cost.

The most dangerous author, and indeed one with whom it is most difficult to deal, is one who has a major part in the direction of the company as a whole. When we have, for example, a vice-president in charge of manufacture who is an inventor of sorts, or who thinks he is, we have a situation which is difficult of restraint within the organization. His associates who could restrain him have not sufficient technical knowledge to appraise his ideas, while his subordinates, who have the knowledge, do not in many cases dare to tell him the truth. Men of this type do not take kindly to the most constructive criticism of their ideas and after a period become surrounded by a group of "yes" men, whose purpose in life is to glorify and flatter the boss and thereby hold their jobs. These pseudo-scientists in high executive positions are by no means rare and their experiments are costly.

In such a situation, a chemical engineer not directly responsible to the inventor-executive can

serve as a balance wheel. His bread and butter must not depend on the favor of the executive, and if, as he should be, he is jealous of his own professional reputation for judgment, he will not hesitate to appraise the idea or projected development as cold-bloodedly as if it were the idea of anyone else in the organization. He must be tactful, but none the less, positive. Further, his advice will be taken with better grace and more alacrity than the same advice from a subordinate. A man is seldom a prophet in his own country. Usually, too, the failures of developments in such an organization are saddled on some obscure scapegoat who is unable to "pass the buck." Some $45-per-week chemist or draftsman is fired, and the fact that some one higher up is really responsible does not become apparent until a multiplicity of unsuccessful ventures, staggering in their aggregate expense, wake the financial interests to the fact that all is not as it should be.

The financial interests of a company usually have the background to evaluate developments in sales policy, advertising, and similar purely commercial matters. They rarely have the background to similarly evaluate technical developments. To the average high-class business man or financier, there is a halo of mystery around these matters and always a promise of magical returns, returns which often are not realized. The chemical engineer can convert these mysteries into terms they can fully understand, and that understanding is very effective insurance against dissipation of assets in rainbow-chasing.

I do not want to be understood as in any way opposed to technical development, for I feel that any company which does not have an adequate development policy is open to suspicion and may at any time be rendered impotent because of obsolescence. However, unintelligent development and exaggerated pride of authorship not only divert assets into unproductive lines but actually prevent development along the lines where the company future should lie. It not only contracts present dividends but also those of the future, whereas intelligent technical development, while it may absorb capital for a time, inevitably gives disproportionately large returns later, and is the life blood of company growth.

This in rather general terms, is the aid given by the chemical engineer to interests already financially involved in a company or contemplating such a financial participation. In what specific way does a chemical engineer function in such matters, particularly in matters into which "pride of authorship" enters?

All basic development matters, when handled in a logical manner, pass through three well-defined phases: (1) laboratory; (2) semi-works; (3) pilot plant. The laboratory is the initial work on the very small scale. This is followed by the semi-works, which makes the product on a large enough scale to determine the essentials of plant design and to make enough product to test out the market. The final stage of pilot-plant operation is fully commercial, being the operation of a single full-scale unit to determine final costs and actually market the product. Duplication of pilot-plant units is all that is required for further commercial expansion.

It is at the end of each of the stages that the most important function of the chemical engineer enters. With all the information available, he projects a dollars and cents balance which indicates the results to be expected from the project, and on this basis it can be determined whether the next step is advisable and justified. In very unusual cases it may be sound judgment to go from the laboratory to the pilot-plant without the semi-works; in other words, to make the pilot plant, the semi-works as well. In most instances this is a serious error of judgment but one which too much pride of authorship may lead an organization to do. Experimental work on the full scale always is costly and often foredoomed to failure. The chemical engineering balance brings out these points clearly; it sets maximum and minimum limits for costs at every stage and substitutes certainty for conjecture in so far as it is humanly possible. Much human action is based on 98 per cent rumor and 2 per cent fact, and it is the business of modern chemical engineering to reverse these percentages and attempt to reach the Ivory ideal of 99.44 as far as fact is concerned.

Often at the end of one or another stage of an investigation, a cold-blooded impartial marshaling of the facts shows that on any reasonable assumption as to the future, the work should stop right where it is. Pride of authorship is prone to make the unreasonable assumption which will justify continuance, regardless of the probability. The properly "engineered" financial man will say, "All right, gamble on this if you will, but not with my money."

Where an industry is to be financed by additional capital, the source furnishing it makes a study of the industry as a matter of routine, and in these modern and progressive days gets the chemical engineering angle as well as those of the appraisal and the ordinary balance sheet. It has become more and more appreciated that a chemical engineering survey of plants and developments can go a long way toward predicting probable future profits. It is not so well recognized that a consideration of the general development of science and technology, and how this general exterior development is going to affect the interior affairs of the industry in question, is also of vital importance. Examples of industries thrown out of joint by such recent developments as synthetic ammonia and synthetic methyl alcohol are by no means rare. Although these developments had their effects only

(Continued on Page 16)

MATHEMATICS

A Brief History

Man, from earliest antiquity, has required some means of counting or recording things and objects. Primitive peoples often devised systems based upon five; the reason for this being the number of fingers on the hand. As an example, in Greenland, on the Orinoco and amongst the aborigines of Australia six is "one on the other hand," ten is two hands. Evidences of this manner of counting are still to be found in the languages of people who use a strictly decimal notation; for example, the English word "score" in the expression "three score years and ten," the French numeral quatrevingts (four 20's) and the Roman notation. The ancient Babylonians used a system involving sixties which has influenced our own method of measuring time and angles. Whatever system may be used the enumerating of real things in groups is, and always has been the root principle of mathematics. Our "numberings" have become more complicated because of community life and progress in civilization. But all computations, no matter how removed from a mere enumeration of things, ultimately rest on this fundamental principle of arithmetic.

Babylon and Egypt

The earliest recorded information pertaining to mathematics apparently comes from Babylon and Egypt. Clay tablets (probably of date 3000 to 2000 B. C.) indicate that the Babylonians had a well developed system of numbers and a knowledge of land measures and surveying. They divided the circumference of the circle into 360 parts now known as degrees. It is probable that they knew that the radius could be applied as a chord exactly six times to the circumference and that each part cut off would contain 60 degrees. As did the early Hebrew and the Chinese they evaluated π.

Probably the earliest definite knowledge of Egyptian mathematics is to be found in the British Museum. A treatise written on papyrus by one Ahmes, at least as early as 1700 B. C., is still extant. This writer states that the same is a copy of an original dating back as far as 3000 B. C.

The great structures built by the Egyptians indicate that a considerable knowledge of applied mathematics was available. Geometry, as a practical art, is said to have originated in Egypt. The Greek termed the Egyptian surveyors "harpendonaptai" or rope stretchers. These surveyors understood the method of constructing a right angle by using the proportions 3:4:5 and accomplished the actual act by tying knots in ropes. According to Herodotus, the Greek historian, surveying was developed by the Egyptians in order to relocate land after the annual inundations of the Nile.

Greece

As a people the Greeks have perhaps never been equalled as students of philosophy and amongst their most brilliant achievements are the development and application of mathematics. As a matter of fact, the Greeks changed mathematics from a set of practical rules to a science. The geometrical theories and practices of the Egyptians greatly interested one Thales (640-546 B. C.) a merchant of Miletus. Late in life he established a school for mathematics in his native city. He calculated the heights of the pyramids by means of the lengths of their shadows, and located the positions of ships at sea by means of similar triangles.

Amongst the most renowned of the Greek philosophers was Pythagoras (582-500 B. C.). To him the entire universe had a mathematical basis. He is credited with the discovery of "irrational numbers" such as $\sqrt[3]{}$. The accomplishment which has perhaps made him best known to history is the formulation of the so-called Pythagorean theorem, in which the square on the longest side of a right angled triangle is equal to the sum of the squares on the other two sides.

The middle one of the great Greek philosophical trinity, Socrates, Plato and Aristotle, and who lived from 429-347 B. C., urged upon his pupils intensive study of mathematics. The development of solid geometry received considerable impetus from some of the pupils of the great Plato.

The division of geometry into "books" as it appears in the present day school book can be attributed to Euclid, about 300 B. C. The formal statement of theorems, the constructions, proofs and conclusions, with but minor alterations and additions, have been used by text-books for over 2000 years. Aside from sacred writings no work has ever been so widely used or translated into so many languages as have been the Elements of Euclid.

In Archimedes (287-212 B. C.) the ancient city of Syracuse produced one of the greatest mathematicians of antiquity. As a geometrician and physicist ancient history records no superior. The methods he employed in the solution of different problems in mechanics savor strongly of those of the calculus of modern times. He determined the value of π correctly to the third decimal place. Amongst his contributions to the theory of mechanics may be noted the formulation of the laws of the lever, of the pulley, and of the screw. The so-called Principle of Archimedes is one of the

most important propositions in hydrostatics.

Hindus and Arabs

The ancient Hindus evinced a pronounced talent for numerical computation, and used the knowledge of Babylon and of Greece which they incorporated into a system of their own. They worked out many independent and interesting results. Apparently they were the first to use the symbol "0" to mark the place value of notation. For example, in 51 50 1, the five means five tens, while in VI = V + 1, the V means simply five ones. This improvement in symbols has proven extremely valuable and has prompted the greatest advances in mathematics. History records two mathematicians of the Hindu school Brahmagupta (about 600 A. D.) and Bhaskara (about 1100 A. D.).

To the Arabs must be given most of the credit for the development of algebra. They carried to Europe a knowledge of Eastern mathematics and from the 9th to the 13th centuries Spain and Arabia were the seats of great institutions and of remarkable scientific activity, and to these activities we owe the preservation of much of the mathematical knowledge of the ancients. Apparently the word algebra comes from the Arabic al-jebr. The term was used as a title of a book on the science of mathematics in the 9th century. Of all the conquests of the Mohammedan Arabians none has left a more indilible impression upon civilization than their development of algebra.

European Renaissance

In the 16th century Ferro, Ferrari and Tartaglia in Italy and Viete in France carried on and developed algebra to the point that made possible its application to geometry. Descartes, the great French mathematician, invented a new and simple means for studying many curves which had previously proven extremely difficult, or impossible, of solution.

To Keplar, Descartes and Pascal must be attributed the development of pure geometry and to Fermat that of the theory of numbers.

The invention of logarithms is conceded to be one of the greatest of all time. They were originally the work of Napier and were developed and simplified by Briggs in such a manner as to make comparatively easy computations without which it is probable neither science nor civilization could have attained its present stage. What is generally conceded to be the outstanding mathematical invention or discovery of any age is the, differential and integral, calculus which must be credited to Sir Isaac Newton and Gottfried Leibnitz. The controversy between these two men as to whom the credit belonged was unfortunate in that it embittered the latter years of the life of the great German philosopher. It would appear from the expression of opinion registered by students of the subject that Newton's method of fluxions and Leibnitz's method of infinitesmals were independent and original discoveries. But little short, in value, of the calculus is analytical geometry, the invention of Rene Descartes, the great French philosopher, of this same period. To these inventions must be attributed the mathematical developments of Euler, Lagrange and Laplace.

Modern Mathematics

Since the day of Newton, the older branches of mathematics have steadily developed and many new ones have arisen. Of these latter some of the most important are differential geometry, non-Euclidean geometry, vector analysis, quarternions, determinants, functions of a complex variable and other phases still understood only by the authors thereof and a few individuals.

Some Famous Problems

The development of geometry was materially aided by the appearance of problems which seemed to defy solution. The ancients were much intrigued by efforts to duplicate the cube, square the circle and trisect the angle. Each of these problems is capable of a practical solution by modern methods. However, the conditions laid down in the original formulation were that the solutions must be effected without instruments other than the compass and the unmarked straight edge and based upon such conditions they are still unsolved.

Squaring the Circle

This problem calls for the determination of a square exactly equal in area to a given circle. The problem resolves itself into that of arriving at the exact value of π. It has been shown in modern times that the exact determination of this ratio is impossible.

Duplication of the Cube

This problem is said to have originated with the oracle of Apollo, whose shrine was at Delos. It was known as the Delian problem. The oracle is reputed to have said to the Athenians that an existing pestilence would cease if they would double the cube-shaped pedestal of the altar of Apollo, that is to say, replace it by another of twice the original volume. This results in the requirement of the solution of the equation of $X^3 = 2a^3$. The solution of this develops a incommensurable quantity which cannot be represented with the limitations originally set forth. Through the use of the higher plane curves and of methods similar to those of modern analytical geometry the problem was solved practically by the ancient Greeks.

Trisection of any Angle

There are many methods of trisecting an angle, and the modern dividing engine makes possible the construction of scales by means of which any angle may be trisected within very small limits of accuracy. None of these methods, however, is limited to the use of the compass and the unmarked straight edge. Modern mathematics indicates that the resulting equations are irreducible and may be solved by the aid of a finite number of square roots only for special values of the angle. Many claims

(Continued on Page 17)

CODES FOR KINGS CHAPTER

To Be Voted On At Fall Meeting

Kings County Chapter, the first to respond to the request for a Chapter Code, has presented to its members the following for consideration and approval at the fall meeting of the Chapter:

CODES OF ETHICS AND PRACTICE

The master copy, from which this copy differs in but a few details, was adopted at Rochester, September 24, 1930.

Foreword

In the interest of the public welfare and the advancement of the engineering profession, the following Codes of Ethics and Practice are subscribed to by the membership of Kings County Chapter of the New York State Society of Professional Engineers. Violations of these Codes shall be deemed cause for examination of facts in accordance with the provisions of the Constitution and By-Laws of Kings County Chapter and if of sufficient gravity may, upon recommendation of the Committee on Ethics and Practice and a three-quarters affirmative approval of the Executive Board of the Chapter, be considered sufficient cause for expulsion from the Chapter.

Ethics

A. (1) GENERAL PRINCIPLES—The engineer shall recognize his duty to society, to his profession and to himself. He shall conduct his practice in a manner consistent with the ideals of courtesy, personal honor and the ethics of a learned profession.

(2) He shall consider himself a gentleman and member of a learned profession and shall deport himself accordingly.

B. (1) RELATIONS WITH THE PUBLIC—The engineer shall at all times and under all conditions seek to promote the public welfare by safeguarding life, health and property.

(2) He shall not become associated with enterprises inimical to the public welfare, nor shall he identify himself with any project not of a legitimate character.

(3) He shall promote and assist endeavors to advise the public of the requrements, responsibilities and accomplishments of the profession and its members. Publicity detrimental to the establishment and recognition of engineering as a learned profession, or which lauds the individual to the disparagement of his fellow practitioners, is deemed to lower the dignity of the profession and is condemned.

(4) He shall discourage indiscriminate and improper use of the term engineer and shall bear in mind that the aim of engineers should be to restrict the term to those recognized by law as professional men.

(5) He shall promote efforts tending to interest engineers to assume active participation in public affairs.

C. (1) RELATIONS WITH CLIENTS AND EMPLOYERS—The engineer shall at all times advise his client, or employer, of interests, affiliations or prejudice which might influence his judgment or impair the quality of his services.

(2) He shall, to the best of his ability, advise client or employer, before undertaking any work, of conditions or influences tending to defeat the purposes or objects of such work.

(3) He shall regard as confidential, information or knowledge of a client's or employer's affairs.

(4) He shall not, in connection with any particular project, accept compensation, financial or otherwise, from any person other than client or employer, without consent of all interested parties.

(5) He shall not make a practice of offering professional services or counsel without fee.

D. (1) RELATIONS WITH ENGINEERS—The engineer shall not compete with fellow practitioners on the basis of professional charges, fees or other financial remuneration.

(2) He shall not enter into competition for, nor attempt to secure professional work awarded on a basis of competitive bidding. Such practice is detrimental to the public welfare, degrades the profession and is strongly condemned.

(3) He shall not intentionally injure the reputation, prospects, or business of another engineer, nor shall he anonymously review or criticize the work of another engineer.

(4) The engineer shall refrain from endorsing or condemning ideas, theories, processes or proposals of fellow practitioners, unless he is especially qualified by reason of his experience to so do, and unless such action on his part is required because of his business connection with clients, or because said idea, theory or proposal may be considered dangerous or harmful to the engineering profession or to the public welfare.

(5) He shall not seek to displace a fellow practitioner.

(6) He shall not seek to retain or employ engineers at a remuneration incommensurate with the service rendered.

(7) He shall recognize licensed engineers of the State of New York as members of his profession and shall at all times extend courtesies and considerations, not inconsistent with practice nor injurious to personal interests, to fellow engineers.

(Continued on Page 18)

A FEW QUESTIONS

To Refresh the Memory

Give the name: of a noted Italian Arctic explorer; of the inventor of carborundum.

With what activity is each of the following names chiefly associated: Alexander Graham Bell, Sir Henry Bessemer, John, James and Daniel Bernoulli.

Mention an institution founded by Peter Cooper; By Ezra Cornell.

What change in astronomy is associated with the name of Copernicus?

What unique honor in science was won by Madame Curie?

State the chief contributions to science by Louis J. Mande Daguerre; by John Dalton; by Sir Humphrey Davy.

What recent inventions owe much to the activities of De Forest?

Who first propounded the atomic theory in ancient times?

What was Descartes's chief contribution to mathematics?

For what is each of the following people particularly noted: Thomas Edison, Alexandre Eiffel, Albert Einstein?

Name the originator of the Fahrenheit scale on thermometers.

Who was the English chemist that first used the terms "anode" and "cathode."

What Persian poem did Fitzgerald popularize in the English-speaking world? (Just to relieve the tension).

What important scientific discovery was made by Benjamin Franklin?

What achievements justified the election of Robert Fulton to the American hall of fame?

Catalogue the contributions of Galileo to science and inventions?

Mention two conspicuous achievements of G. W. Goethals in addition to his construction of the Panama canal.

What is invar, and who originated it?

What was the occasion of Leibnitz's controversy with Newton?

What was De Lessep's greatest engineering triumph?

Indicate the principal scientific achievements of Michelson; of Millikan.

What famous actress had a son highly distinguished as a bridge engineer.

Give an account of the steps by which Newton reached a verification of the law of gravitation.

Make a list of the contributions of Papin to science and invention.

Who designed the New York subway?

Describe the chief ideas or principles with which Pythagoras' name is associated.

MISCELLANEOUS INFORMATION

A Few Discoveries, Beginnings and First Uses

Aberration of light discovered by Bradley, 1725.

Adrenalin prepared by Takamine, 1901.

Agricultural chemistry founded by Liebig, 1840.

Airplane mail service, first regular transcontinental trip, New York to San Francisco, September 8-11, 1920.

Antiseptic surgery introduced by Dr. Lister, 1867.

Armor plate for steel vessels made in U. S., 1889.

Atomic numbers determined by means of X-ray spectrums, Mosley, 1914.

Atomic structure, concentric shell theory presented by Langmuir, 1919.

Bacteria discovered by van Leeuwenhoek, 1680.

Baldwin locomotive, first, 1832.

Benzene ring theory devised by Kekule, 1865.

Brick, first made in America, Virginia, 1612.

Carrel-Dakin antiseptic treatment of infected wounds, first used, 1915.

Cast-iron bridge first in America over Erie canal at Frankfort, N. Y., 1840.

Cell theory of organic structure formulated by Schwann, 1839.

Cholera bacillus discovered by Koch, 1884.

Coal first mined in America, Virginia coal mine, on James river, Chesterfield county, 1750.

Anthracite first successfully used in American blast furnace, at Pottsville and at Catasauqua, Pa., 1839.

Coal-tar dye, mauve, discovered by Perkin, 1856.

Cotton manufacturing begun in South, about 1870.

Cotton spinning mill, first complete in U. S., built by Samuel Slater for Moses Brown at Pawtucket, R. I.

Cotton spinning and weaving mill, first complete, built at Waltham, Mass., by Francis Cabot Lowell, 1814.

Diamond, atomic structure determined by Bragg by means of the X-ray, 1913.

Diphtheria antitoxin discovered by Behring, 1889.

Diphtheria germs discovered by Klebs, 1883.

Dynamo, first to give continuous current, constructed by Charles Wheatstone, 1841.

Electron, charge of an, measured, by Millikan, 1909.

Expansion of gases, law of, announced by Charles, 1787.

Fertilization, artificial, of eggs of sea urchin by means of chemicals, Jacques Loeb, 1910.

Fixed stars, Halley discovers the proper motions of, 1718.

Gas, coal, first used by William Murdoch, Cornwall, 1792. First used for street lighting, London, 1807. First used for street lighting, in America, Baltimore, 1821.

Germ plasm, Weismann announced his theory of, 1892.

Hydrophobia, Pasteur introduced his famous antitoxin treatment to prevent, 1885.

Ice, artificial, first plant, New Orleans, La., 1866.

Incandescent lamp, first commercially successful, made by Thomas A. Edison, 1879.

Insulin, an internal secretion of the pancreas, is proved by Banting and co-workers to be specific for relief of diabetes, 1922.

Iron, angle iron, first rolled in U. S., Pittsburgh, 1819.

Shot for use of Continental army, made at Durham, Bucks county, Pa.,—shipped Aug. 25, 1775, by George Taylor, a signer of Declaration of Independence.

T. Rails, rolled in U. S. Alegany county, Md., 1844.

Lavoisier discovered relation of metals to oxides, 1782.

Light, velocity proved by Majorana to be independent of the velocity of its source, 1919.

Logarithms invented by Napier, 1614.

Malaria, parasites discovered by Laveran in 1880.

Motion, Kepler published his three laws of 1609-19.

Mutation theory published by De Vries, 1901-03.

Neanderthal man skeleton found, 1856.

Newton's famous Principia, in which he demonstrated the law of gravity, published 1687.

Nitrogen atom decomposed with emission of hydrogen, when subject to action of alpha rays, Rutherford, 1919.

Phosphorus, first used in matches, in England, 1833.

Plague bacillus discovered by Kitasato and Yersin, 1894.

Porcelain, furst true (hard paste) made in Europe by J. F. Bottger, about 1709; in U. S., at Philadelphia, 1825.

Quantum theory of energy developed by Planck, 1901.

Skyscraper, first, "Rookery" office building, Chicago, 1887.

Steam engine, first entirely constructed in America, Belleville, N. J., 1794.

Steam power first used for printing, London Times, 1814.

Steel, first made in America, Hartford county, Conn., 1728. Bessemer steel, first produced in

(Continued on Page 17)

A BASIS OF HARMONY

A Constructive Suggestion from the Engineers' License Board

The following resolution adopted over one year ago and approved by engineers throughout the state is so eminently fair and so fundamentally sound as to warrant reprinting in the hope of favorable reaction from the sister profession of architecture.

RESOLUTION

ADOPTED FEBRUARY 22, 1930, BY THE NEW YORK STATE BOARD OF LICENSING FOR PROFESSIONAL ENGINEERS AND LAND SURVEYORS

WHEREAS, Interpretations of the New York State Architects' Registration Law (Chapter 572 of the Laws of 1928) and of the provisions of the Multiple Dwellings Law (Chapter 713 of the Laws of 1929) have demonstrated a conflict between those laws and the New York State Professional Engineers' Licensing Law (Chapter 775 of the Laws of 1920 and amendatory acts);

WHEREAS, Through such conflict, the designing of certain structures and the filing of plans in certain cases have been permitted to only one professional group and have been prohibited to another duly and properly qualified group;

WHEREAS, Such prohibition cuts off the long established means of livelihood of members of such professional group; and

WHEREAS, The sole purpose of all legislation governing professional practice is to protect the public by safeguarding life, health and property; and it is not the purpose of such legislation to secure any advantages to one profession at the expense of another duly and properly qualified profession;

BE IT RESOLVED

That the New York State Board of Licensing for Professional Engineers and Land Surveyors hereby affirms the following as a statement of its conviction and policy in relation to all existing and proposed legislation relating to these professions and to the interpretation of such legislation:

1. No law predicated on the safeguarding of life, health and property should be open to an interpretation whereby registered architects are deprived from doing any professional work that in the past has been regularly and legally done by architects. Similarly, no law predicated on the safeguarding of life, health and property should be open to an interpretation whereby licensed professional engineers are deprived from doing any professional work that in the past has been regularly and legally done by professional engineers.

2. All work that in the past has been regularly and legally done by both architects and professional engineers, including the planning, design, filing of plans, and supervision of construction of structures of all types, should continue to be open to the practice of duly licensed or registered members of both professions.

3. Any attempt or tendency to enact or interpret legislation so as to secure an advantage to one profession by depriving members of another profession of vested rights is to be deprecated.

4. In framing and interpreting any legislation concerning these professions, respect for pre-existing rights of both professions should be a guiding principle. AND BE IT FURTHER RESOLVED:

That the New York State Board of Licensing for Professional Engineers and Land Surveyors hereby invites the New York State Board of Examiners and Registration for Architects, and all organizations of architects and of professional engineers, to join in subscribing to the foregoing statement of guiding principle and policy.

The Board of Licensing for Professional Engineers has rendered a splendid service in the name of justice and common sense. The New York State Society of Professional Engineers has registered its acknowledgment.

The New York State Society of Professional Engineers subscribes fully to the views above expressed and commends them to the members of the architectural profession.

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CONVENTION OF A. S. C. E.

Upholds Unity of Profession

The summer meeting of the American Society of Civil Engineers was held in Tacoma, Washington, July 8th, 9th, and 10th.

Amongst matters of interest are the following:

The Board of Direction voted unanimously in favor of the principle of registration. It appointed a committee of three to collaborate with similar committees from the several founder societies and the American Engineering Council at whose request the entire subject of registration was considered and acted upon. One of the objectives of the proposed joint committee will be the organization of State Councils for the purpose of representing the profession as a whole in legislation and in non-technical matters.

The Board adopted a resolution stressing the unity of the engineering profession and urging that registration or licensing not recognize any subdivision thereof. This is indeed a courteous acknowledgement of the resolution adopted by the New York State Society at its annual meeting.

The efforts of the members of the late Architect-Engineers' Committee, which formulated the proposal to create a professional engineer-"structural," were acknowledged and the committee discharged. This proposal was unquestionably a sincere effort to solve a trying problem. Unfortunately the cure would prove far more disastrous than the present predicament.

President Steinman of the New York State Society described the construction of the St. Johns Bridge at Portland, Oregon. This structure, the longest suspension bridge west of the Mississippi, was designed by the firm of Steinman and Robinson.

NEWS ITEMS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Nominations for Officers – 1932

The candidates proposed by the Nominating Committee of the A. S. M. E. for the year 1932 are as follows:

For President—Conrad Lauer.

For Vice-Presidents—Robert M. Gates, Wm. B. Gregory, Fred H. Dorner, Charles M. Allen.

For Managers—Eugene W. O'Brien, Harry R. Westcott, Alexander J. Dickie.

Mr. Lauer, the candidate for President is an author and lecturer, President of the Philadelphia Gas Works and a member of the engineering firm of Day and Zimmerman.

WATERWAYS CONVENTION

The following interesting article is from the pen of the Chairman of the Publicity Committee of the Society.

On July 7th, the Great Lakes, Hudson Waterways Association convened at Albany. Bronx and Albany Chapters of the Society were represented.

The convention was called for the purpose of furthering interest in an All-American Waterway from the Great Lakes to the upper Hudson; and to present the project, now being advocated by the Central Western states, for a waterway from the Great Lakes through the St. Lawrence River to the Atlantic seaboard.

The seaboard cities now use a greater part of the commodities manufactured or raised in the Central States. If these commodities are shipped through the proposed Canadian waterway and down the St. Lawrence River, it will add 1500 miles to the distance required to reach the eastern markets; and, in the event of strained international relations, (should such a thing occur) central United States would be left without direct access to the sea, and the investment would be useless.

Colonel Edward C. Carrington was Chairman of the Convention. The principal speakers were Senator Royal S. Copeland, Hon. Hamilton Fish and Hon. Hamilton F. Potter.

The Bronx delegation consisting of Prôfessor Alexander Haring, President of the Bronx Chapter, Raymond J. Van Wagner, Charles F. Giraud and Julius Harwood, left New York the evening of July 6th on the S. S. Berkshire, arriving at Albany the followng morning. The Convention opened at the Ten Eyck Hotel at 11:00 A. M. Luncheon was served on board the Berkshire and followed by addresses. The party was then taken on buses on a tour of inspection of the development of the Albany Port Authority, under the guidance of Peter G. Ten Eyck, Chairman, and Arnold G. Chapman, Chief Engineer, respectively of the Albany Port District Commission. (Mr. Chapman is a past President of the Albany Chap-

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ter of the N. Y. State Society of Professional Engineers).

The delegates were amazed at the development of the Albany Port and were able to witness the unloading of pulp wood from Russia.

The Bronx party left in the evening on the Berkshire, and enjoyed the splendor of the Hudson under a full moon, arriving in New York the following morning.

R. J. VAN WAGNER.

AMERICAN ENGINEERING COUNCIL

Advocates Survey Legislation

The Administrative Board of the American Engineering Council has endorsed the proposal of Congressman Temple of Pennsylvania which proposal would insure the early completion of the federal topographical mapping of the entire country. The need for such a measure has been made apparent by the willingness of some states to appropriate money for the purpose of assisting the government and expediting the work.

CHEMICAL ENGINEER IN BUSINESS

(Continued from Page 8)

comparatively recently, yet one conversant with scientific progress could have readily predicted it several years before the event. The laboratories of all countries are busy with development work which is going to affect certain of our industries basically within the next decade. The scientific literature is full of signposts to those who can read and comprehend.

The work of the chemical engineer must not stop with the initial financing if the integrity of the investment and its maximum return is to be maintained. The financial interests back of any company which engages in major technical development should insure themselves by chemical engineering advice unbiased by pride of authorship. This can best be done by using an independent chemical engineer of the proper type to review major development matters at each stage of development where appropriations are required. In the last analysis such procedure is very cheap insurance. However, only in rare instances is it in actual operation today. Where it is, the effect on the organization is salutary.

Furthermore, knowing that each proposition put up for approval is to be subjected to critical analysis, there will at once be a tendency toward intelligent conservatism and more critical review within the organization. There will be proper hesitancy in pushing forward schemes which are half-baked in their technical phases and which, in the absence of critical technical check-ups, might be expected to slip through unnoticed. Less total development may be the result, but the sum total

of productive development and consequent dividends will be greater.

I have merely touched the high spots of some of the uses of chemical engineering to the modern financier. The interests of the financier and the chemical engineer are identical, as far as industry is concerned, and they should endeavor to understand one another better. Much progress has already been made in this direction, but much more is yet to come. Then there will be less lost motion, even more intelligent financial management, and further increase in dividends, all of which are certainly desired for the development and extension of American industry.

MATHEMATICS

(Continued from Page 10)

have been made and are continually being made that this problem can be solved with the requirements as originally set forth, but definite proof seems to be lacking.

Evaluation of the Ratio

The earliest determinations of π were probably either guesses or calculations made by determining the perimeter of a regular polygon having so great a number of sides as to approach a circle in character. By such means the value was known to fifteen decimal places by the end of the 16th century. This information required the calculation of the perimeter of a polygon of over one billion sides. By the use of infinite converging series Wm. Schanks in 1873 carried the value to 707 decimal places. The results indicate that π cannot be expressed as a decimal, as a surd or as an algebraic number.

Conclusion

Modern science relies almost entirely on the mathematician. To the joint efforts of the pure-mathematician and the practical scientist is due, in a very large degree, the advance of knowledge. The history of modern mathematics is a story of an ever increasing development of two interdependent aspects of the science: the inner realm of order among mathematical ideas themselves, and the outer realm which seeks domination over material objects of time and space.

With mathematics as the machine Einstein has soared to heights beyond the imagination of most of mankind, and the evidence increases that mathematics, perhaps more than any other subject known to man, is the open sesame to the countless mysteries of the universe.

MISCELLANEOUS INFORMATION

(Continued from Page 13)

U. S., Wyandotte, Mich., Kelly pneumatic process, 1864.

Sun proved to be a magnetized sphere, 1912-13.

Sun's atmosphere analyzed by means of the spectroscope, Kirchhoff, 1860.

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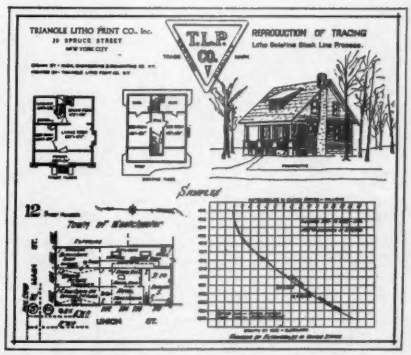

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Technical school first in English-speaking country, except West Point, Rensselaer Polytechnic Institute, Troy, N. Y., 1824.

Tetanus germs discovered by Nicolaier, 1884.

Tubercle bacillus discovered by Robert Koch, 1882.

Typhoid bacillus discovered by Eberth, 1880.

Typhus fever shown by doctors Ricketts and Wilder to be transmitted by body lice, 1910; the germs were first discovered by Dr. H. Plotz, 1915.

Vaccination; Dr. Jenner makes his first innoculation, 1796.

Velocity of light determined by Roemer, 1675.

Wire suspension bridge, first in world, over Schuylkill river, near Philadelphia, 1816.

Wool spinning machine in a factory, Peace Dale, R. I., 1804.

X-rays used to show molecular structure of crystals, Laue, 1912.

Yellow fever organism isolated by Noguchi, 1919.

CODES FOR KINGS CHAPTER

(Continued from Page 11)

(8) He shall render assistance and encouragement to engineering students and apprentices and shall recognize the worth of their services.

Practice

E. (1) The engineer is entitled to compensation for all professional advice and service. His charge therefor shall conform to general practice and he shall not render professional services for rates less than those recognized or established as minimum.

(2) He shall retain, as personal property, all original plans, specifications, designs, studies, patents, and other engineering data developed as a result of his work, unless an agreement to the contrary has been entered into with client or employer.

(3) He is charged with the exercise of quasi-judicial functions in matters of dispute and his position shall at all times be that of an impartial arbiter.

(4) He shall recognize the limitations of his qualifications and, shall, where advisable, consult, retain or co-operate with, experts and specialists, whether members of his profession or otherwise.

(5) He shall not seek to hold out the work of others as his own, and he shall not render professional services to persons or groups who refuse to credit him with such services.

(6) He shall assume responsibility for professional work performed by him or under his direction, and wherever possible shall sign the drawings, specifications and other papers accompanying such work.

(7) He shall maintain a dignified interest in the affairs of the community and shall advise and co-operate generally with those interested in, or

concerned with, matters of an engineering character which are pertinent to the public welfare.

(8) He may establish, where and within limits desirable, schedules, classifications and other criteria for the guidance of the public or members of the profession.

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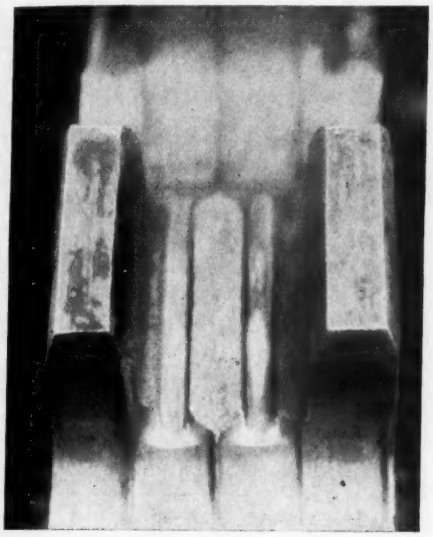

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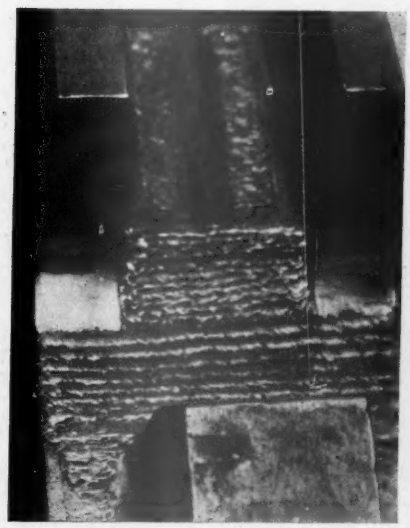

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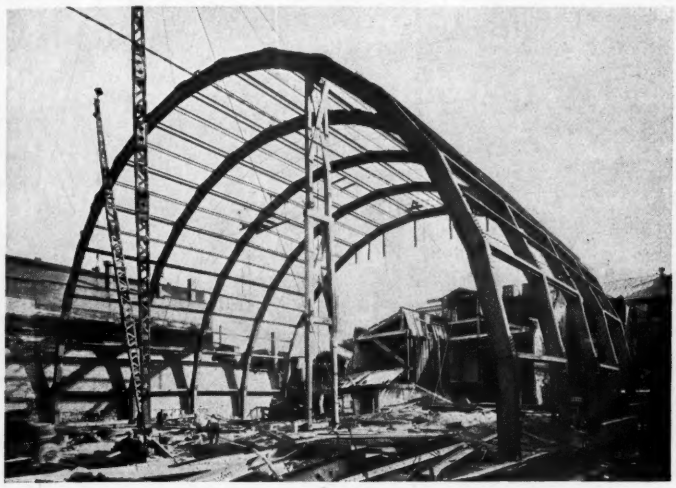

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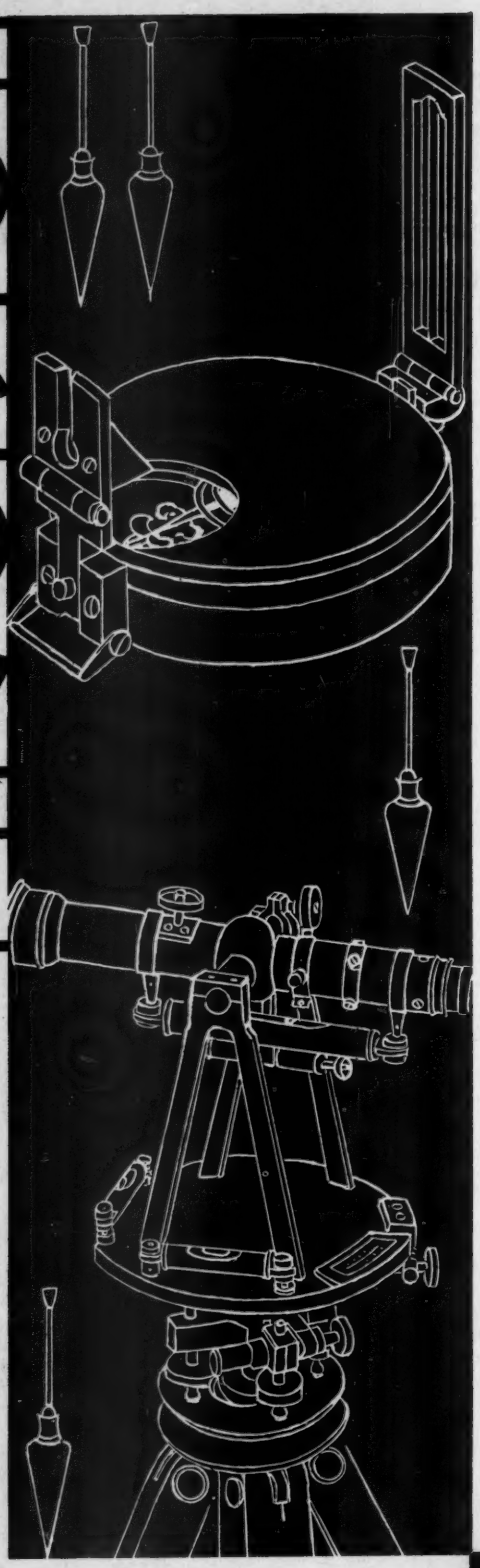

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